

**WHAT IS CLAIMED IS:**

1           1.     An automated process for isolating and amplifying a target analyte  
2     that may be present in a fluid sample contained in each of a plurality of reaction  
3     receptacles, said process being performed at a plurality of stations between which  
4     each reaction receptacle is transported by an automated receptacle transporting  
5     system including one or more automated receptacle transport mechanisms, each  
6     said automated receptacle transport mechanism being constructed and arranged to  
7     retrieve at least one of said reaction receptacles from one of said stations and  
8     transport said reaction receptacle to another of said stations, said plurality of  
9     reaction receptacles being initially held in a holding station for holding said  
10    plurality of reaction receptacles prior to commencement of said process, said  
11    process comprising the following steps performed on each of said reaction  
12    receptacles:

13                retrieving one of said reaction receptacles from said holding station with  
14     said automated receptacle transporting system, wherein each said reaction  
15     receptacle retrieved from said holding station further contains a solid support  
16     material;

17                transporting said reaction receptacle to a first incubation station with said  
18     automated receptacle transporting system, said first incubation station comprising  
19     one or more incubators, each defining an enclosed temperature-controlled  
20     incubation chamber;

21                permitting said reaction receptacle to dwell within said incubation  
22     chamber of said first incubation station for a period of time and under conditions  
23     sufficient to permit said target analyte to be immobilized by said solid support  
24     material;

25                retrieving said reaction receptacle from said first incubation station with  
26     said automated receptacle transferring system;

27                transporting said reaction receptacle to a separation station with said  
28     automated receptacle transporting system;

29                performing a target analyte separation procedure at said separation station,  
30     wherein said target analyte separation procedure includes isolating said solid

31 support material within said reaction receptacle from said fluid sample and  
32 removing said fluid sample from said reaction receptacle;  
33 retrieving said reaction receptacle containing said solid support material  
34 from said separation station with said automated receptacle transferring system;  
35 transporting said reaction receptacle to a second incubation station with  
36 said automated receptacle transporting system, said second incubation station  
37 comprising one or more incubators, each defining an enclosed temperature-  
38 controlled incubation chamber, wherein said first and second incubation stations  
39 are independent of one another or share at least one incubator in common;  
40 dispensing an amplification reagent into said reaction receptacle prior to  
41 or after transporting said reaction receptacle to said second incubation station;  
42 and  
43 permitting said reaction receptacle to dwell within said incubation  
44 chamber of said second incubation station for a period of time and under  
45 conditions sufficient to permit said target analyte to be amplified.

2. The method of claim 1, wherein said target analyte separation procedure further comprises:

dispensing a wash buffer into said reaction receptacle after removing said fluid sample from said reaction receptacle;  
agitating said reaction receptacle to mix said wash buffer and said solid support material;  
isolating said solid support material within said reaction receptacle from said wash buffer; and  
removing said wash buffer from said reaction receptacle.

3. A transport mechanism for transporting a reaction receptacle between stations of an automated analyzer, the reaction receptacle including a manipulating structure, said transport mechanism comprising:  
a receptacle carrier assembly constructed and arranged to be rotatable about an axis of rotation and to receive a reaction receptacle and carry the

6 reaction receptacle while said receptacle carrier assembly rotates about said axis  
7 of rotation;

8 a manipulating hook member interrelated with said receptacle carrier  
9 assembly so as to be movable with respect thereto, said manipulating hook  
10 member being constructed and arranged to be engageable with the manipulating  
11 structure of the reaction receptacle; and

12 a hook member drive assembly including a hook motor having fixed  
13 structure carried by said receptacle carrier assembly in a fixed position with  
14 respect thereto and a lead screw mechanism including a threaded shaft oriented in  
15 a generally radial direction with respect to said axis of rotation and having an end  
16 coupled to said manipulating hook member, said lead screw mechanism being  
17 operatively coupled with said hook motor and being constructed and arranged to  
18 convert powered motion of said hook motor into movement of said threaded shaft  
19 with respect to said fixed structure of said hook motor in either axial direction of  
20 said threaded shaft to thereby cause corresponding movement of said  
21 manipulating hook member with respect to said receptacle carrier assembly so  
22 that a reaction receptacle engaged by said manipulating hook member can be  
23 moved with respect to said receptacle carrier assembly.

4. An incubator for receiving a plurality of reaction receptacles  
containing reaction fluids and maintaining the reaction fluids in a temperature  
controlled environment, said incubator comprising:

a housing including a receptacle access opening formed therein for  
allowing movement of a reaction receptacle into or out of said housing through  
said receptacle access opening;

a command-responsive closure mechanism connected to said housing in  
proximal relation to said receptacle access opening, said command-responsive  
closure mechanism being constructed and arranged to be movable between a  
closed position and an open position with respect to said receptacle access  
opening in response to corresponding closure movement commands to prevent or  
permit access to said housing through said access opening,

13                   said housing and said command-responsive closure mechanism  
14                   constituting an enclosure defining an incubation chamber therein;  
15                   a heat source in thermal communication with said incubation chamber;  
16                   a powered fan mechanism disposed within said incubation chamber and  
17                   constructed and arranged to generate air movement within said incubation  
18                   chamber to promote a generally uniform temperature distribution internal to said  
19                   incubation chamber;  
20                   a receptacle carrier disposed within said incubation chamber and  
21                   including a plurality of receptacle stations, each of said receptacle stations being  
22                   constructed and arranged to carry a single reaction receptacle, said receptacle  
23                   carrier being constructed and arranged to present any of said plurality of  
24                   receptacle stations in a receptacle transfer position with respect to said access  
25                   opening.

26                   5.       An incubator for receiving a plurality of reaction receptacles  
27                   containing reaction fluids and maintaining the reaction fluids in a temperature  
28                   controlled environment, said incubator comprising:  
29

30                   a housing including a receptacle access opening formed therein for  
31                   allowing movement of a reaction receptacle into or out of said housing through  
32                   said receptacle access opening;  
33

34                   a command-responsive closure mechanism connected to said housing in  
35                   proximal relation to said receptacle access opening, said command-responsive  
36                   closure mechanism being constructed and arranged to be movable between a  
37                   closed position and an open position with respect to said receptacle access  
38                   opening in response to corresponding closure movement commands to prevent or  
39                   permit access to said housing through said access opening,  
40

41                   said housing and said command-responsive closure mechanism  
42                   constituting an enclosure defining an incubation chamber therein;  
43

44                   a heat source in thermal communication with said incubation chamber;  
45                   a receptacle carrier disposed within said incubation chamber and  
46                   including a plurality of receptacle stations, each of said receptacle stations being  
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constructed and arranged to carry a single reaction receptacle, said receptacle carrier being constructed and arranged to present any of said plurality of receptacle stations in a receptacle transfer position with respect to said access opening; and  
a receptacle mixing mechanism mounted on said housing and constructed and arranged to agitate a reaction receptacle carried in a receptacle station disposed in an operative position with respect to said mixing mechanism to thereby mix the reaction fluids contained in the reaction receptacle.

6. Modules for an automated analyzer comprising:

(A) a transport mechanism for transporting a reaction receptacle from one of said modules to another of said modules, the reaction receptacle including a manipulating structure, said transport mechanism comprising:

(1) a receptacle carrier assembly constructed and arranged to be rotatable about an axis of rotation and to receive a reaction receptacle and carry the reaction receptacle while said receptacle carrier assembly is rotating about said axis of rotation;

(2) a manipulating hook member interrelated with said receptacle carrier assembly so as to be movable with respect thereto, said manipulating hook member being constructed and arranged to be engageable with the manipulating structure of the reaction receptacle; and

(3) a hook member drive assembly including a hook motor having fixed structure carried by said receptacle carrier assembly in a fixed position with respect thereto and a lead screw mechanism including a threaded shaft oriented in a generally radial direction with respect to said axis of rotation and having an end coupled to said manipulating hook member, said lead screw mechanism being operatively coupled with said hook motor and being constructed and arranged to convert powered motion of said hook motor into movement of said threaded shaft with respect to said fixed structure of said hook motor in either axial direction of said threaded shaft to thereby cause corresponding movement of said

manipulating hook member with respect to said receptacle carrier assembly so that a reaction receptacle engaged by said manipulating hook member can be moved with respect to said receptacle carrier assembly; and

(B) an incubator for receiving a plurality of the reaction receptacles containing reaction fluids and maintaining the reaction fluids in a temperature controlled environment, said incubator comprising:

(1) a housing including a receptacle access opening formed therein for allowing movement of a reaction receptacle into or out of said housing through said receptacle access opening;

(2) a command-responsive closure mechanism connected to said housing in proximal relation to said receptacle access opening, said command-responsive closure mechanism being constructed and arranged to be movable between a closed position and an open position with respect to said receptacle access opening in response to corresponding closure movement commands to prevent or permit access to said housing through said access opening,

said housing and said command-responsive closure mechanism constituting an enclosure defining an incubation chamber therein;

(3) a heat source in thermal communication with said incubation chamber;

(4) a receptacle carrier disposed within said incubation chamber and including a plurality of receptacle stations, each of said receptacle stations being constructed and arranged to carry a single reaction receptacle, said receptacle carrier being constructed and arranged to present any of said plurality of receptacle stations in a receptacle transfer position with respect to said access opening,

said incubator being positioned radially outside an arc swung by said receptacle carrier assembly of said transport mechanism to permit said receptacle carrier assembly to rotate without interference from said incubator and said

54 incubator being oriented so that said access opening is positioned adjacent the arc  
55 swung by said receptacle carrier assembly of said transport mechanism to permit  
56 said transport mechanism:

57 (a) to insert a reaction receptacle carried thereby through said access  
58 opening and into an empty one of said plurality of receptacle stations by rotating  
59 said receptacle carrier assembly into cooperative alignment with said receptacle  
60 access opening and moving said manipulating hook member in a first direction  
61 with respect to said receptacle carrier assembly when said command-responsive  
62 closure mechanism is in said open position to move the reaction receptacle from  
63 said receptacle carrier assembly, through said receptacle access opening, and into  
64 supported engagement within the empty receptacle station, and

65 (b) remove a reaction receptacle from a receptacle station of said  
66 receptacle carrier by rotating said receptacle carrier assembly into cooperative  
67 alignment with said receptacle access opening and moving said manipulating  
68 hook member in said first direction when said command-responsive closure  
69 mechanism is in said open position to insert at least a portion of said  
70 manipulating hook member through said receptacle access opening to engage the  
71 manipulating structure of the reaction receptacle carried in said receptacle station  
72 and subsequently moving said manipulating hook member in a second direction  
73 with respect to said reaction receptacle carrier assembly to draw the reaction  
74 receptacle from said receptacle station, through said receptacle access opening,  
75 and into supported engagement within said receptacle carrier assembly.

1 7. A device for performing a magnetic separation purification  
2 procedure on a solution which includes magnetically responsive particles and is  
3 contained in a reaction receptacle, said device comprising:

4 a receptacle carrier unit constructed and arranged to receive a reaction  
5 receptacle containing a solution which includes magnetically responsive particles  
6 and to carry the reaction receptacle throughout the magnetic separation  
7 purification procedure;

8 a magnet moving structure including at least one magnet generating a  
9 magnetic field, said magnet moving structure being constructed and arranged to  
10 move said at least one magnet between first and second positions with respect to  
11 the reaction receptacle carried in said receptacle carrier unit,  
12 wherein said magnetic field of said at least one magnet draws the magnetically  
13 responsive particles to an inner surface of the reaction receptacle adjacent to said  
14 at least one magnet when said at least one magnet is in said first position, and  
15 wherein the effect of said magnetic field on said magnetically responsive particles  
16 is less when said at least one magnet is in said second position than when said at  
17 least one magnet is in said first position;

18 a fluid transfer mechanism constructed and arranged to selectively  
19 dispense fluid into the reaction receptacle carried in said receptacle carrier unit  
20 and withdraw fluid from the reaction receptacle; and

21 a carrier agitator mechanism operatively coupled to said receptacle carrier  
22 unit and constructed and arranged to impart a cyclic motion to said receptacle  
23 carrier unit to agitate and mix the solution contained in the reaction receptacle  
24 carried in said receptacle carrier unit.

8. An assembly comprising:

25 a first ring assembly constructed and arranged to be rotatable about a first  
26 axis of rotation, said first ring assembly including an annular fluid container  
27 carrier portion having an inner periphery and an outer periphery between which  
28 said fluid container carrier portion is defined, said fluid container carrier portion  
29 being constructed and arranged to carry a plurality of fluid containers; and

30 a second ring assembly constructed and arranged to be rotatable  
31 independent of said first ring assembly about a second axis of rotation that is  
32 generally parallel to said first axis of rotation, said second ring assembly being  
33 positioned with respect to said first ring assembly so that at least a portion of an  
34 outer perimeter of said second ring assembly is disposed radially inwardly of said  
35 inner periphery of said fluid container carrier portion of said first ring assembly,



13 said second ring assembly being constructed and arranged to carry a plurality of  
14 pipette tips thereon.

1 9. The assembly of claim 8, wherein said second ring assembly  
2 includes a pipette tip carrier portion having an inner periphery and an outer  
3 periphery between which said pipette tip carrier portion is defined, and wherein  
4 said assembly further comprises an inner rotatable assembly constructed and  
5 arranged to be rotatable independent of said first and second ring assemblies  
6 about a third axis of rotation that is generally parallel to said first and second axes  
7 of rotation, said inner rotatable assembly being positioned with respect to said  
8 second ring assembly so that at least a portion of an outer perimeter of said inner  
9 rotatable assembly is disposed radially inwardly of said inner periphery of said  
10 pipette tip carrier portion of said second ring assembly, said inner rotatable  
11 assembly being constructed and arranged to carry a plurality of fluid containers  
12 thereon.

13 10. A device for agitating the fluid contents of at least one container,  
14 said device comprising:

15 a turntable structure constructed and arranged to be rotatable about a first  
axis of rotation;

one or more container holders, each having an axis of rotation and being  
constructed and arranged to hold a container therein, said container holders being  
mounted on said turntable structure so as to be rotatable therewith and so that said  
axis of rotation of each container holder is generally parallel to said first axis of  
rotation;

a container holder mounting assembly associated with each one container  
holder, said container holder mounting assembly being constructed and arranged  
to mount said associated container holder to said turntable structure and to permit  
said associated container holder to rotate about a second axis of rotation that is  
generally parallel to and spaced from both said first axis of rotation and said axis  
of rotation of said container holder; and

and